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Total Number of Pages : 02

B.Tech
PET3I103

3rd Semester Back Examination 2019-20

SIGNAL & SYSTEMS

BRANCH : ECE, ETC

Max Marks : 100

Time : 3 Hours

Q.CODE : HB895

Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.

The figures in the right hand margin indicate marks.

Part- I

Q1 Only Short Answer Type Questions (Answer All-10) (2 x 10)

- Define energy and power signal.
- Find whether the following system with impulse response is $h(t)$ is stable or not. $h(t) = te^{-t}u(t)$.
- Write the condition for stability of a DT-LTI system with respect to the position of poles.
- Give Parseval's relation for continuous Time Fourier Transform.
- State and prove time folding property of z-transform.
- Will there be two different signals having same Laplace transform? Give an example. How do you differentiate these two signals ?
- State the significance of impulse response.
- What is aliasing?
- State multiplication property of DTFT.
- What is the difference between recursive and non-recursive system?

Part- II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

- Find the even and odd component of the signal $x(n) = \{1, 0, -1, 2, 3\}$
- Find out whether the following signals are periodic or not. If periodic find the period.
 - $x(t) = 2 \cos(10t + 1) - \sin(4t - 1)$
 - $x(n) = \cos(0.1\pi n)$
- Using Laplace transform of $x(t)$. Give the pole-zero plot and find ROC of the signal $x(t)$. $x(t) = e^{-bt}t^2$ for both $b > 0$ and $b < 0$.
- Obtain the Fourier coefficient and write the quadrature form of a fully rectified sine wave.
- Find out whether the following signal is energy or power signal or neither any of two. Determine power or energy if found.
$$x(t) = u(t) + 5u(t - 1) - 2u(t - 2)$$
- What is the transfer function and the impulse response of RC low pass circuit?
- Determine the unit step response of the LTI system defined by $d^2y/dt^2 + 5dy/dt + 6y(t) = dx/dt + x(t)$.
- State and prove any two properties of continuous Time Fourier Transform.
- Find the convolution of sum of $x[n] = r[n]$ and $h[n] = u[n]$
- obtain the parallel realization of the system given by $y(n) - 3y(n-1) + 2y(n-2) = x(n)$.
- Determine DTFT of $\left(\frac{1}{2}\right)^n u(n)$. Plot its spectrum.
- Using the properties of inverse Z-transform solve

$$X(z) = \log(1 + az^{-1}); |z| > |a| \text{ and } X(z) = \frac{az^{-1}}{(1 - az^{-1})^2}; |z| > |a|$$

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Using graphical method, find the output sequence $y[n]$ of the LTI system whose response $h[n]$ is given and input $x[n]$ is given as follows. $x[n] = \{0,5,2\}$ and $h[n] = \{1,1,1\}$. **(16)**

Q4 For a causal LTI system the input $x(n)$ and output $y(n)$ are related through a difference equation $y(n) - \frac{1}{6}y(n-1) - \frac{1}{6}y(n-2) = x(n)$. Determine the frequency response $H(e^{j\omega})$ and the impulse response $h(n)$ of the system. **(16)**

Q5 a) It is given that the state matrices for a discrete time system are $A = \begin{bmatrix} 0 & 1 \\ 2 & 3 \end{bmatrix}, B = \begin{bmatrix} 0 \\ 1 \end{bmatrix}, C = [8 \ 8], D = [1]$. Find the system transfer function. **(8)**

b) Find DTFT of $x(n) = [0, 1, 2, 1, 0]$ **(8)**

Q6 a) Consider an analog signal $x(t) = 5 \cos 200\pi t$.
a. Determine the minimum sampling rate to avoid aliasing. **(8)**
b. If sampling rate $F_s = 400 \text{ Hz}$. What is the DT signal after sampling?

b) Determine the Fourier transform for double exponential pulse whose function is given by $x(t) = e^{-a|t|}, a > 0$. Also draw its amplitude and phase spectra. **(8)**